

Student Activity 2: Unidentified Circular Objects (UCO's)

Overview: Students investigate the relationship between the diameter of a circular light on a surface produced by a flashlight and the distance of the flashlight from the surface.

Objective: **Algebra I TEKS**
 (b.1.B) The student gathers and records data, or uses data sets, to determine functional (systematic) relationships between quantities.
 (b.1.E) The student interprets and makes inferences from functional relationships.
 (c.1.A) The student determines whether or not given situations can be represented by linear functions.
 (c.1.C) The student translates among and uses algebraic, tabular, graphical, or verbal descriptions of linear functions.
 (c.2.B) The student interprets the meaning of slope and intercepts in situations using data, symbolic representations, or graphs.

Terms: diameter, trend line, linear model, rate of change, slope, y-intercept

Materials: flashlights (one per group), rulers, yardstick or meter stick, graphing calculators

Procedures: Students should be seated at tables in groups of 3 – 4.

Activity 1: Unidentified Circular Objects

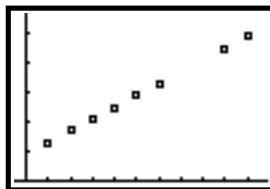
Briefly describe and/or demonstrate the experiment. Make sure students hold the meter stick perpendicular to the surface on which the light is shining.

1. Stress how important it is for students to predict the results of the experiment **before** they perform the experiment. Encourage students to think about and anticipate the results of the experiment before they begin collecting data.

2. *Sample data:*

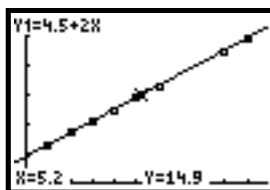
Distance (cm)	Diameter
1	6.5
2	8.5
3	10.6
4	12.4
5	14.5
6	16.3
9	22.3
10	24.6

3. Sample data:



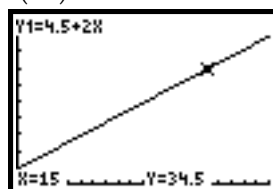
4. Rate of change is approximately 2 cm/cm
5. Estimated starting point is 4.5 cm.
6. $y = 4.5 + 2x$

7. Sample data:



8. The units of slope are centimeters per centimeters.
9. The real world meaning of the y-intercept is that if the flashlight was no centimeters from the surface, the circular light pattern would have the y-intercept as its diameter.
10. The equation is $y = 4.5 + 2(15) = 34.5$. Some solution methods:

$$4.5 + 2(15) = 34.5$$



X	Y1
10	24.5
11	26.5
12	28.5
13	30.5
14	32.5
15	34.5
16	36.5

Y1=34.5

11. For our sample data, solve: $4.5 + 2x = 18$

Table:

X	Y1
6	16.5
7	18.5
8	20.5
9	22.5
10	24.5
11	26.5
12	28.5

X=7

X	Y1
6.7	17.9
6.8	18.1
6.9	18.3
7.0	18.5
7.1	18.7
7.2	18.9
7.3	19.1

X=6.7

X	Y1
6.7	17.9
6.71	17.92
6.72	17.94
6.73	17.96
6.74	17.98
6.75	18
6.76	18.02

X=6.75

Other Table:

X	Y1	Y2
5	14.5	18
6	16.5	18
7	18.5	18
8	20.5	18
9	22.5	18
10	24.5	18
11	26.5	18

X=6

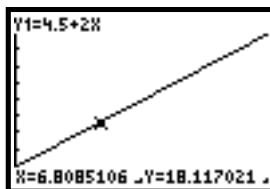
X	Y1	Y2
6.7	17.9	18
6.8	18.1	18
6.9	18.3	18
7.0	18.5	18
7.1	18.7	18
7.2	18.9	18
7.3	19.1	18

X=6.7

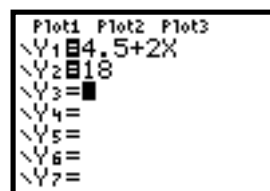
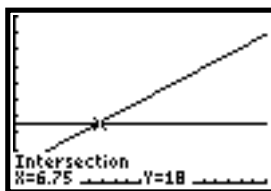
X	Y1	Y2
6.7	17.9	18
6.71	17.92	18
6.72	17.94	18
6.73	17.96	18
6.74	17.98	18
6.75	18	18
6.76	18.02	18

X=6.75

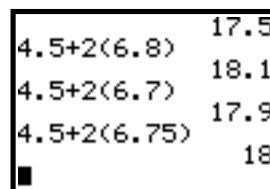
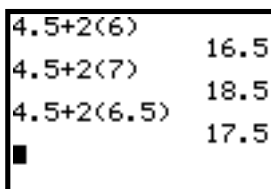
Trace:



Trace to the
Intersection point.



Guess and check.



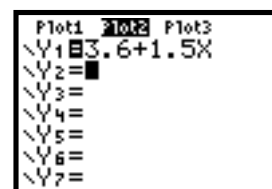
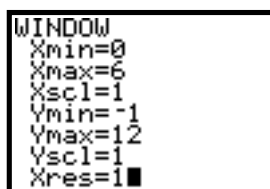
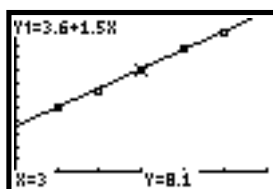
Solve algebraically, if you are at a place in your curriculum where it makes sense for students to do so:

$$\begin{aligned}
 4.5 + 2x &= 18 \\
 4.5 + 2x - 4.5 &= 18 - 4.5 \\
 \left(\frac{1}{2}\right)2x &= 13.5\left(\frac{1}{2}\right) \\
 x &= 6.75
 \end{aligned}$$

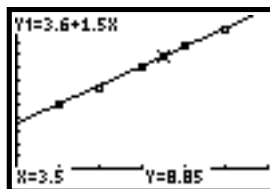
12. The further from the surface the flashlight is, the larger the circular light pattern produced.

Answers to Sample Assessment:

1.

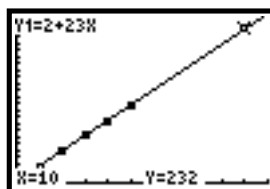


2. Trace to $x = 3.5$

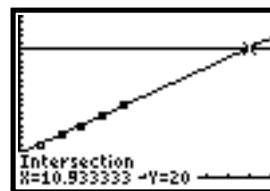
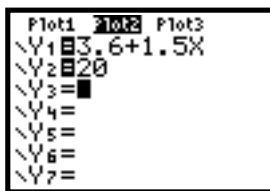


3. Two graphical methods:

Trace to $y = 20$



Trace to the
intersection of
 $y = 3.6 + 1.5x$
and $y = 20$

**Summary:**

By collecting data and finding a trend line, students investigate the relationship between the diameter of the circular light pattern produced by a flashlight at varying distances from the surface. Students use real data to further their conceptualization of the linear function.